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HIGHLIGHTS

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Special Report -- U. S. Military Space Programs

Here is a Special Report, based on official information, of space and "space-related" programs of the Department of Defense and the Army, Navy and Air Force. For the Fiscal Year which begins July 1, 1960 the Administration has requested some $471 million.

* Communications Project (Project Notus)

This project is now divided into two major efforts, Courier, a delayed repeater communications project and Advent, an active instantaneous repeater satellite system. Courier satellites are scheduled for launching during the period July to September, 1960 and will contain several transmitters and receivers with associated tape recorders. Advent program provides for three satellites equally spaced around the earth in a 19,200 mile orbit so that they remain approximately stationary over one point on the earth. Several satellites in polar orbit will "fill in" polar regions. Objective of Advent is to prove the feasibility of complete global communications for ground-to-ground, ground-to-ship and ground-to-aircraft transmission.

* Navigation Satellite (Project Transit)

Objective is precision navigation, world wide coverage, simplicity of mobile navigation equipment, and all-weather capability. Satellites are equipped with special radio transmitters which provide coded information and a time signal. By use of this information, in conjunction with tables and by use of doppler techniques, it is expected that observing ships and planes can determine their positions to an accuracy within a fraction of a mile. First Transit satellite, September 1959, failed to orbit. Second, launched in April 1960, demonstrated feasibility. Two additional launches are scheduled this year.

* Satellite Tracking (Project Shepherd)

This program consists of Spasur a modified active minitrack "fence" across the southern U. S. to detect "silent" satellites. Certain improvements in capabilities are contemplated. Most of the remaining funds are allocated for a National Space Surveillance and Control Center planned as headquarters for data reduction, analysis, cataloging and disseminating of information. Limited operations are now underway at Cambridge, Mass.

(For further details of the above programs see Washington SCIENCE TRENDS, Vol. IV, No. 6, April 25, 1960: Special Report, Advanced Research Projects Agency)

* Discoverer Program

Objective of Discoverer is a research and development program directed toward developing a satellite vehicle (Agena) and to demonstrate operation of subsystems including guidance and control, stabilization in orbit, techniques and procedures for tracking, acquisition and command of vehicle in orbit and recovery of capsule from orbit. Air Force believes that all major objectives, except recovery, have been demonstrated and an extension to the program may be planned. Agena vehicle has proved to be reliable from standpoint of propulsion, guidance and control, command acquisition and stabilization.

* Reconnaissance Satellite (Project Samos)

This program is aimed at a system to acquire, process and distribute photographic and other reconnaissance information. Much of the basic engineering derives from the Discoverer project, including the Agena satellite and much of the ground station complex which will be modified with specialized equipment. Additional stations are planned for location in New Hampshire, Iowa and Oregon. All Samos vehicles will be launched with ICBM boosters from the Pacific Missile Range into polar orbit. Recent plans indicate some decrease in the rate of effort being applied toward certain classified aspects of this program.

* Missile Defense Alarm Satellite (Project Midas)

This program is aimed toward continuous screening of worldwide launchings of ballistic missiles through detection of infrared from the associated exhaust plumes through powered ascent of the missile or missiles. Instantaneous reporting by the satellite to a ground station is planned, with a relay to "appropriate operational forces" for maximum warning of hostile attack. First Midas vehicle launched from the Atlantic Missile Range February 1960 failed to orbit, presumably due to failure at separation of the Atlas and Agena stages due to an explosion of the Atlas retrorockets. Modifications are underway for second launching, due shortly.

Proposed operational system consists of a classified number of satellites in polar orbits launched to an altitude of 2,000 nautical miles from the Pacific Missile Range. Samos tracking and acquisition stations, and additional facilities, will be used for appropriate command control and readout. Plans call for integration with other ballistic missile early warning communications lines. A considerable expansion of funds for this program is currently being arranged.

* Dynasoar Project

This program is aimed toward development of a military test system which will explore and solve problems of hypersonic flight including controlled manned return from near-orbital velocities. Vehicle will consist of a large, multistage rocket which will boost a manned test vehicle to near orbital velocity. Test vehicle will have global range, will be able to maneuver in the atmosphere and return to a military base for normal landing.

Step One is planned for full-scale unmanned gliders to be boosted by a Titan ICBM, to be followed by manned glider experiments. This is the only phase of the program now authorized. As orginally planned, Step Two would require larger boosters not specified and would include studies of the military uses of such a system. Step Three would include studies of weapons systems growing out of the Dynasoar development.

Other Major Military Space Funding Includes:

*X-15, the program for research into manned aircraft performance at speeds up to mach 6.5 and altitudes of more than 250,000 feet. This is planned as a $6 million program in Fiscal 1961.

*Atlantic Missile Range, operated under Air Force contract with a total plant value estimated at $515 million as of June 30, 1959, and a total 1961 budget of about $133 million.

*White Sands Missile Range, operated by the Army with a total plant value of about $234 million and a 1961 budget of about $94 million.

*Pacific Missile Range, managed by the Navy with a total plant value estimated at $131 million and a 1961 budget of about $81 million.

*General Research and Component Development, includes programs of the various services in such fields as space maneuverable and recovery systems; guidance, control and navigation components; and rocket engine development. No budgetary breakdown available.

*Ground Based Equipment, includes certain space surveillance, tracking and control equipment; environmental test facilities and test centers. No budgetary breakdown available.

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*Precision Measurement Laboratories

The U. S. Air Force is embarked on a broad program to bring precision measurement equipment laboratories to many of its installations in the U. S. and abroad. A complete calibration system is being established.

National Bureau of Standards will provide the common reference standards for all measurements to be used in the system. These will, in turn, be the responsibility of an Air Force Standards Calibration Facility at Heath, Ohio; depot-level standards facilities at 16 Air Force locations and approximately 160 base-level facilities. Each of the facilities will provide calibration services for those standards or testing devices employed at the next lower echelon.

Air Force officials have explained that modern military equipment has enormously increased the requirements for measuring and testing devices. Hundreds of thousands of these devices are in use and must be kept in good repair and calibrated periodically with a certified standard of known accuracy. Measurements that were generally obtainable only at research and development laboratories a decade ago must now be made routinely--at the base level. Most base laboratories are being established through modification of existing buildings. However laboratories will be built at at least 12 bases during the next fiscal year at costs of from $32,000 to $65,000.

The top Air Force facility, at Heath, Ohio will have extremely precise control over temperature, pressure, humidity and cleanliness, plus the highest order of seismic stability. Electrical-electronic, electromechanical and dimensional measurements will be made. Air Force also hopes to use Heath to repair Atlas, Titan, Minuteman and Hound Dog inertial guidance systems. However, Navy also plans an inertial guidance lab at Johnsville, Pa. and Congress may well order both facilities combined.

* Zinc Anodes

U. S. Navy, Bureau of Ships, is currently evaluating the use of zincs for corrosion protection of the salt water sides of heat exchangers. A large number of ships are participating. However, tests have not yet indicated whether the zincs might be eliminated in any of the exchangers.

Navy finds that despite the use of special resistant alloys corrosion in the presence of flowing sea water can be traced to such external factors as the use of contaminated water from polluted harbors; bimetallic corrosion caused by the coupling of dissimilar metals; air entrainment in the water; crevice corrosion at poorly gasketed joints or at badly expanded tubes and local velocities of water at the tube ends exceeding design velocity of the material because of angle flow.

For the present, the Navy has adopted a "safety first" policy -- zincs will continue to be installed in heat exchangers unless otherwise specified.

* Stable Gage Blocks

Significant progress is reported by the National Bureau of Standards in its long-range program aimed at an accuracy of 1 part in 10 million in gage block calibrations. The steel blocks are used to monitor manufacturing processes in the mass production of interchangeable machined parts. Extremely stable blocks are required for "space age" applications including the making of machine tools, ball bearings and missile control mechanisms.

Gage Block Metallurgy program, with industry cooperation, is aimed at development of blocks that will retain their calibrated lengths to high degree of surface finish, flatness of surface, parallelism of opposite gaging faces, and resistance to wear, deformation and atmospheric and even fingerprint corrosion.

Greatly improved stability has already been obtained on blocks of 410 stainless and 52100 modified steel. Annealed 410 stainless blocks, with nitrided surfaces, have expanded only 0.0000002 inches per inch per year. Gage blocks of 52100 steel, with special stabilizing and stress-relieving treatments, have displayed a shrinkage of only 0.0000004 inches per inch per year.

Other materials under study and treatment include 1010; W 4 Tool Steel; 8620; 304 stainless; 405 stainless; 420 stainless; D 2 Tool Steel; Nitralloy 135 Mod; 17-4 PH stainless; Titanium Carbide A; Titanium Carbide B; Titanium Carbide, steel binder; T 15 Mod Tool Steel and Aluminum Oxide.

Special Measuring techniques have also been developed at the Bureau to obtain precise data on the small dimensional changes.

(For Further Details write National Bureau of Standards, Office of Technical Information, Washington 25, D. C. Ask for STR - Extremely Stable Gage Blocks)

* Electronic Landing System

Navy has signed an initial $4.3 million contract with Avionics Division, Bell Aircraft Co. for a "hands off" carrier landing system. The system, designated AN/SPN-10 incorporates stabilized glide scope information, ship motion prediction and precision radar. Two radars mounted on the carrier's superstructure track an incoming airplane. Two visual displays provide information on location with respect to the carrier deck, while computers determine whether the aircraft is on the proper descent course.

RESEARCH CHECKLIST

( ) Radiography of Fuel Oil Heater Elements: Radiographic techniques have been developed by the Navy to provide a non-destructive means of evaluating internal corrosion of fuel oil heater elements in a ship. Previous hydrostatic testing had led to costly repair and delays. A reference gage is employed to establish the percentage of wall thickness remaining at the pits in the tube. This device, in combination with an x-ray machine and densitometer, now permits the detection of elements with extensive depth of pitting, and replacement before failure in service.

(R&D reported by N. G. Wayne and J. F. McKenna, U. S. Naval Shipyard, Boston, Mass.)

( ) Crawling Vehicles: The Army is sponsoring studies of possible vehicles which would use legs or levers instead of wheels for crawling, creeping, walking and jumping. Analytical studies have already indicated that walking and walking-crawling configurations would not be practical. The "pure crawling vehicle" is now receiving the most attention.

(Studies by the University of Michigan for Land Locomotion Laboratory, Detroit Arsenal, Center Line, Mich.)

( ) Pulse Power Laboratory: Simulation of certain aspects of high altitude nuclear explosions is being carried out by the Air Force. Materials to be tested are placed in an explosion chamber located above four low inductance condensors capable of storing 16,000 joules of electrical energy at 125,000 volts. The chamber can be evacuated to correspond to various altitudes and energy is then released or "dumped" from the condensors into the test materials. Peak power is estimated at 10 billion watts for about one-half a microsecond.

(R&D by Laboratory Branch, Physics Division, Special Weapons Center, U. S. A. F., Albuquerque, New Mex.)

( ) Liquid Hydrogen Pump: Generally satisfactory performance has been achieved with a specially-designed low-speed, submerged, piston-type pump for handling boiling hydrogen. A piston pump was selected because of its independence of pressure on speed, small leakage areas, low shaft speeds and low intake velocities. Submerged operation was chosen because it eliminates the need for a separate pump housing and avoids the accompanying heat leak to the fluid. In addition, vapor can separate from the liquid during the induction process. Tests were made with JP-5 fuel, liquid nitrogen and liquid hydrogen.

(Detailed Report Available. 26 Pages. Single Copies Free. Write NASA, 1520 H Street, N. W. Washington 25, D. C. ATTN: Code BID for Technical Note D-276)

( ) Transistorized Sonar: A completely transistorized sonar system has been developed to provide Navy divers and underwater demolition teams the ability to locate submerged objects in dark and murky waters. The unit, designated AN/PQS-1, is slightly larger than a basketball and weighs 20 pounds. Grips at the side of the aluminum casing are held by the diver, permitting easy maneuverability and control. The unit is powered by standard flashlight batteries and is equipped with ear phones for audio information.

(R&D by Stromberg Carlson Co., San Diego, California and the U. S. Navy Electronics Laboratory)

PUBLICATION CHECKLIST

( ) Tungsten Ore Technology, a new illustrated report on tungsten uses, production, consumption and prices; and current techniques in reducing tungsten trioxide to metal and in forming the metal and its carbides. Also contains information required for analyzing tungsten and its ores. 120 Pages. 60 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for U. S. Bureau of Mines Inf. Circular 7912)

( ) Thermal Conductivity of Solids, a review by the Diamond Ordnance Fuze Laboratories, U. S. Army, of literature on the thermal conductivity of solids, emphasizing measurement techniques at high temperatures. A brief abstract accompanies all publications since 1940. 72 Pages. Prepared June, 1959 and now available. $2. (Write OTS, U. S. Department of Commerce, Washington 25, D. C. for PB 161 118)

( ) Nose Ablation for Ballistic Vehicles, a mathematical study and simplified analysis of the ablation experienced by ballistic vehicles. Researchers found that the heat lost by radiation is negligible to that disposed by ablation. The change in the shape of a nose cone during re-entry is also examined. 30 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D. C. ATTN: Code BID for NASA Technical Note D-254)

( ) Atlantic Missile Range, a Congressional staff report critical of some past practices at Cape Canaveral, Fla. and calling for accelerated development of range instrumentation, equipment and techniques. 7 Pages. Mimeographed. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, The Capitol, Washington 25, D. C. for Staff Report -- Atlantic Missile Range)

( ) Color Code for Resistors, a 1960 revision of the uniform military color code for insulated, axial-lead, composition-type and wirewound-type fixed resistors used by the Army, Navy and Air Force. 8 Pages. 20 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Pub. D 7.10:221A)

( ) Mechanics of Rarefied Gases, a section of the military Handbook of Supersonic Aerodynamics dealing with quantitative information believed to be of interest to the designer working with problems of high-speed, high-altitude flight. 90 Pages. $1.25. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Pub. D215.7:1488/v.5/sec.16)

( ) Aircraft Industry, a Bureau of Census report now available on 1958 facts and figures for the aircraft industry showing that since 1954 value of reported work fell 2 percent and employment declined 17 percent. Other general statistics are broken down on a regional basis. 4 pages. 10 cents. (Available from Field Offices, U. S. Department of Commerce or Write Publication Office, U. S. Bureau of the Census, Washington 25, D. C. for Pub. MC(P) -37B-3)

( ) Hydroelectric Plants, annual supplement, covering 1958, on construction costs and other annual production expenses for hydroelectric plants in the U. S. 88 Pages. 55 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Pub. FP 1.21:139)

( ) Aluminum-Silicon Alloys, a report describing work conducted to determine the feasibility of producing aluminum-silicon alloys in a pit-type three-phase electric arc furnace. 23 Pages. Single Copies Free. (Write Publications-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5575)